

REMARKS

Claims 1-13 and 24-40 are present for the Examiner's review and consideration. Claims 1, 2, and 25 are currently amended, and claims 34-40 are newly added.

Claim 1 has been amended to more particularly define the invention under 35 U.S.C. § 112, second paragraph by clarifying that the evenly applied basic thermal budget is substantially homogenous and even and that it is applied over at least a portion of the weakened zone.

The new claims are fully supported in the specification, claims, and drawings of the originally filed application. For example, claim 34 is supported in the first paragraph of page 12, claim 35 is supported in the first paragraph of page 7 and the related discussion, claim 36 is supported in the last paragraph of page 10, and claims 37-40 are supported in the first full paragraph of page 8 of the application.

In the Office Action, the drawings were objected to for not including numeral 220. Figs. 5A and 5C are presently amended to add this numeral. The specification has also been amended to correctly list numeral 270, where appropriate, which numeral was originally shown in Fig. 5A, and is now also shown in Fig. 5C. These amendments are thus fully supported by the original disclosure.

Claims 2 and 25-32 were rejected under 35 U.S.C. § 112 as being indefinite. Claims 2 and 25 have been amended as suggested, so this rejection is now overcome.

Claims 1-3 and 7 are rejected under 35 U.S.C. § 102(b) as anticipated by Henley '411. Claim 1 is directed to a method of annealing a wafer that has been found to produce much more even and lowered roughness than in the prior art. A substantially homogenous and even basic thermal budget, which is insufficient to detach a detachment layer from a remainder of the wafer at the weakened zone, is applied substantially evenly to at least a portion of a weakened zone of a wafer. Claims 37-40 specify that the even basic thermal budget is applied so that it is even over at least 2/3, 3/4, 90%, and substantially the entire weakened zone, respectively. An additional thermal budget is applied locally in an initiation region of the weakened zone for initiating detachment of the detachment layer at the weakened zone.

Henley teaches implanting particles and subjecting the wafer to an intermediate thermal step below 500 °C (Henley 5:1-10), and differentially heating the substrate to establish a thermal gradient across the assembly (Henley 5:30-35). There is,

however, no teaching or suggestion in Henley that a basic thermal budget should be applied evenly over any portion of the implanted region.

As explained in the application, subjecting a wafer to an environment at a certain temperature is not the same as evenly applying a homogenous and even basic thermal budget. Often, the amount of heat provided needs to be varied at different locations with respect to the wafer to apply the even budget. There is no suggestion to do this at all in Henley.

Furthermore, even the cited disclosure in Henley does not teach or suggest a method in which such an even budget could be applied, mentioning, for instance, a heat lamp used to provide an intermediate temperature of about 350 °C (Henley 27-35), and does not teach or suggest how the heat from the heat lamp could be adequately controlled to produce the even budget.

As explained in the application, the even application of the basic thermal budget, with the additional application of the localized additional thermal budget to initiate the detachment, provides the surprising result over the prior art in that the roughness on the surface of the detached layer is significantly lower and more homogenous and even than in the prior art. This surprising result is not achievable or suggested in Henley, which is not related to providing an even basic thermal budget. Claims 34 and 35 more specifically define the resulting roughness that is achieved. Thus, claims 1, 34, 35, and 37-40, are patentably distinct on their own merits, as well as claims 4, 10, and 25, which recite that the basic thermal budget is evenly applied.

Claims 4-5, 24-26, 30 and 32 were rejected under 35 U.S.C. 103(a) as obvious over Henley in view of Nishi; claims 10-12 were rejected under section 103(a) as obvious over Henley in view of the Okayama publication; claims 27-29 were rejected under section 103(a) as obvious over Henley in view of Nishi, in further view of Okayama; and claim 31 was rejected under section 103(a) as obvious over Henley in view of Nishi, in further view of Massey. These additional references, however, do not remedy the deficiencies of Henley, because they neither teach nor suggest providing the even and homogenous thermal budget or the surprisingly improved roughness and its homogeneity that can be achieved when detaching a layer from a wafer.

Nishi, for example, is concerned with applying a uniform temperature to each wafer in the disclosed furnace, but it does not disclose or suggest how an even thermal budget could be applied within each of the wafers themselves. Most likely, the heat distribution within any one wafer would be uneven in Nishi. In claims 4 and 25, the heating elements are

operated to provide different amounts of heat to substantially evenly apply the basic thermal budget, which is not taught or suggested, as explained above. Also, claim 32 defines that the heating elements surround the wafer, while the heater elements of Nishi are instead U-shaped. (Nishi 10:20-24.) Also, one of ordinary skill in the art would not look to Nishi to improve the roughness and homogeneity of a layer after splitting a wafer, so there is no motivation to combine Henley with Nishi as alleged. Consequently, claims 4, 25, and 32 are patentable over the references for these reasons as well.

With respect to Okayama, there is no suggestion of controlling the heating gas to evenly apply a basic thermal budget, and no suggestion of the above-mentioned surprising benefit. Thus, claims 10-12 and 27-29 are patentably distinct therefrom.

The Massey reference also provides no indication of how a basic thermal budget can be applied so that it is substantially even and homogenous, nor does it suggest that there would be the discussed surprising-benefit. This reference thus would not render claim 31 obvious.

Finally, it is noted that new claim 36 defines that the additional thermal budget is applied to provide a hot point, which is not taught or suggested in any of the references.

In view of the foregoing, the entire application is now believed to be in condition for allowance, early notice of which would be appreciated. Should the Examiner not agree, then a personal or telephonic interview is respectfully requested to discuss any remaining issues in an effort to expedite the allowance of this application.

Respectfully submitted,

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ANNOTATED SHEET
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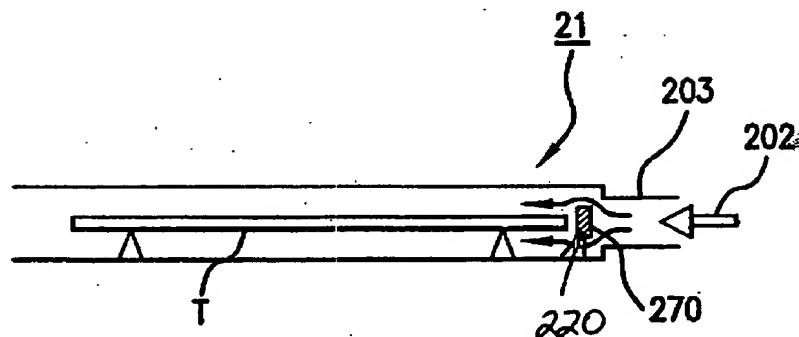


FIG. 5A

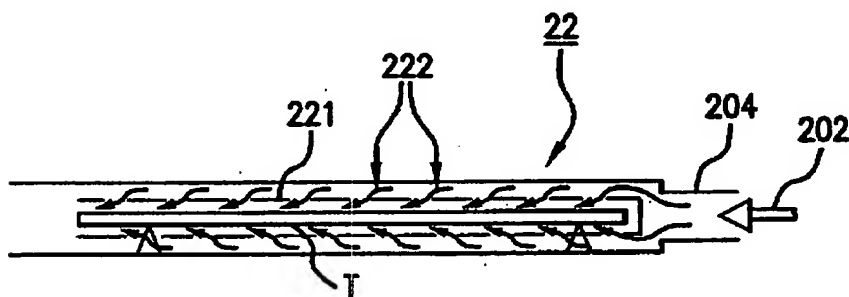


FIG. 5B

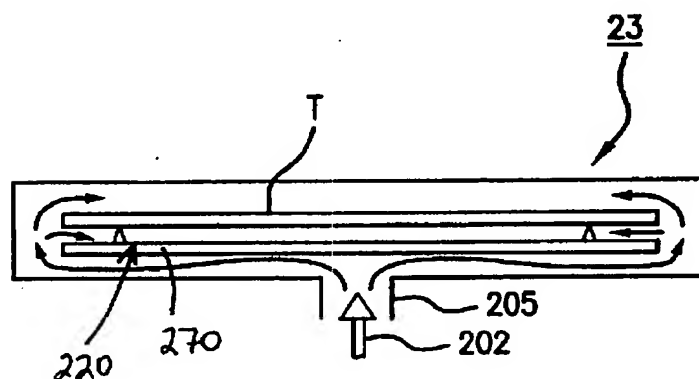


FIG. 5C